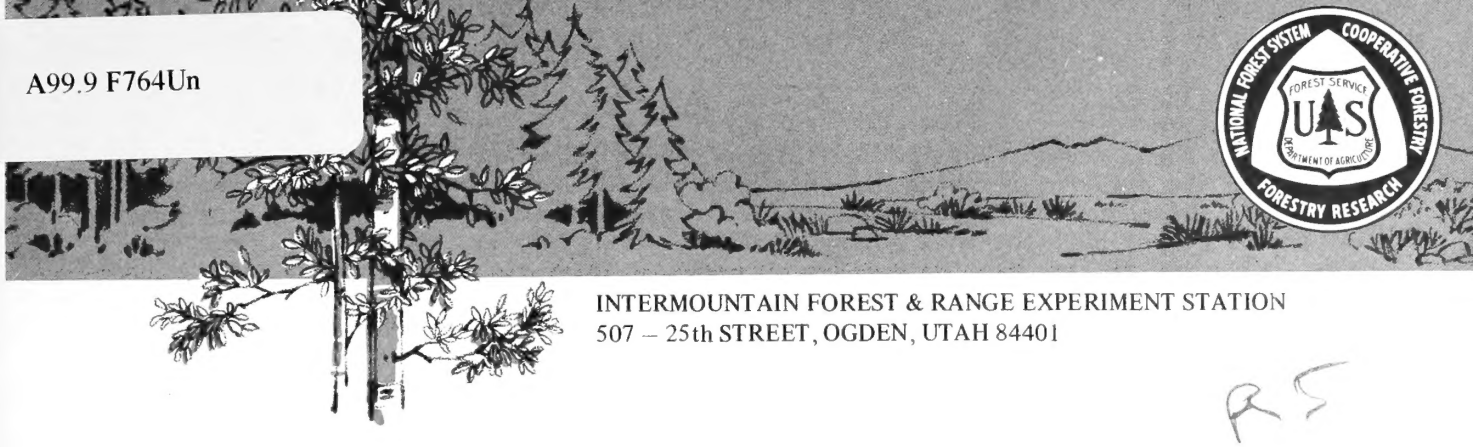

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MERCHANTABLE CUBIC STAND VOLUME CONVERSION FACTORS FOR LODGEPOLE PINE IN MONTANA AND IDAHO

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ABSTRACT

To accommodate the trend toward complete or near-complete utilization of lodgepole pine stems, merchantable cubic volume conversion factors were determined for a range of merchantable d.b.h. and top diameter limits. When used with either the accompanying stand volume equation or table, total volume and merchantable cubic stand volume estimates are easily obtained from field data. Instructions are given for obtaining appropriate data and how to apply them for field estimates of total cubic volume and merchantable cubic volume.

KEYWORDS: stand volume estimation, merchantable volume conversion factors, stand volume table, lodgepole pine

Stand volume equations and tables provide a means for quickly and reliably estimating timber volumes. Foresters can easily obtain and work-up in the field the necessary data on stand height and basal area, and using a stand volume equation or table, quickly compute total stand volume. When accompanied by merchantable volume conversion factors, stand volume equations and tables become even more useful. The author previously developed an equation and table for computing total cubic-foot volume of lodgepole pine stands in Montana and Idaho (Cole 1971), with factors for converting to merchantable cubic volume for utilization to 3-inch (7.6-cm) and 4-inch (10.2-cm) tops.

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Since then, developments in the lodgepole pine fiber and roundwood markets have increased the need for merchantable volume conversion factors for other utilization standards. Among these developments are the continued demand for lodgepole pine fenceposts and corral poles, the expansion of the house log market, the specific merchantability limits of the power pole industry, and the lower top utilization limits brought about by inwoods and mill-site chippers. The purpose of this note, then, is to present a more comprehensive set of merchantable volume conversion factors for use with the lodgepole pine stand volume equation or table.

DEVELOPMENT

For convenience, the earlier-developed stand volume equation is presented here:

$V_T = 0.46952\ (BH) - 32.79$

$r^2 = 0.995$

$S_{y.x} = 82.9\ ft^3/acre$ (2.4 percent of the mean)

where:

V_T = Gross volume in cubic feet per acre of all trees greater than 4.5 feet (1.37 m) in height.

B = Basal area per acre in square feet.

H = Average height of dominant trees in feet.

This equation will be most useful to those having need for a large number of stand volume solutions--as in computer processing applications.

> Caution:--The above equation was developed in English units; hence the equation is applicable only to English units; i.e., basal area in square feet per acre and average height in feet of dominant trees. Upon solution of the stand volume equation in English units, the volume estimate can be converted to metric equivalents and merchantable volume conversion factors can be applied as discussed below.

For convenience of field or occasional use, a stand volume table based on the above equation is presented in table 1 for representative classes of stand basal areas and average heights of dominant trees. Notice that metric equivalents are included in this table, hence the table can be entered (with interpolation for specific basal area and height values as required) to obtain stand volumes in either British or metric units.

Volume conversion factors for lodgepole pine were earlier found to be strongly related to average stand diameter (Myers 1967; Cole 1971). For applications to point-sample cruising, however, the *mean* diameter of trees in the basal area sample is more appropriate because it can be easily obtained by measuring diameters of trees counted in the point sample (Stage 1962). This is discussed further in the application section of this paper.

Factors for conversion of total stand volume (from the equation or table 1) to merchantable cubic feet per acre were determined graphically by plotting ratios of merchantable[2] to total stand volume over the mean stand diameters, obtained from 125

[2]Merchantable stand volumes were based on application of Honer's (1967) volume distribution function for lodgepole pine trees.

Table 1.--*Stand volume table for lodgepole pine in Montana and Idaho* [1/]

Basal Area ft²/ac (m²/ha)	Average height of dominant trees: Feet (Meters) 10 (3.05)	20 (6.10)	30 (9.14)	40 (12.19)	50 (15.24)	60 (18.29)	70 (21.34)	80 (24.38)	90 (27.43)	100 (30.48)
	Stand volume in total cubic feet per acre (m³/ha) [2/]									
30 (6.9)	108 (7.6)	249 (17.4)	390 (27.3)	531 (37.2)	671 (47.0)					
50 (1.5)	202 (14.1)	437 (30.6)	671 (47.0)	906 (63.4)	1,141 (79.8)	1,376 (96.3)				
70 (16.1)	296 (20.7)	625 (43.7)	953 (66.7)	1,282 (89.7)	1,611 (112.7)	1,939 (135.7)	2,268 (158.7)	2,597 (181.7)		
90 (20.7)	390 (27.3)	812 (56.8)	1,235 (86.4)	1,657 (115.9)	2,080 (145.5)	2,503 (175.1)	2,925 (204.7)	3,348 (234.3)	3,770 (263.8)	
110 (25.3)	484 (33.9)	1,000 (70.0)	1,517 (106.1)	2,033 (142.3)	2,550 (178.4)	3,066 (214.5)	3,583 (250.7)	4,099 (286.8)	4,615 (322.9)	5,132 (359.1)
130 (29.8)		1,188 (83.1)	1,798 (125.8)	2,409 (168.6)	3,019 (211.2)	3,629 (253.9)	4,240 (296.7)	4,850 (339.4)	5,461 (382.1)	6,071 (424.8)
150 (34.4)		1,376 (96.3)	2,080 (145.5)	2,784 (194.8)	3,489 (244.1)	4,193 (293.4)	4,897 (342.7)	5,601 (341.9)	6,306 (441.2)	7,010 (490.5)
170 (39.0)		1,564 (109.4)	2,362 (165.3)	3,160 (221.1)	3,958 (277.0)	4,756 (332.8)	5,555 (388.7)	6,353 (444.5)	7,151 (500.4)	7,949 (556.2)
190 (43.6)		1,751 (122.5)	2,643 (184.9)	3,536 (247.4)	4,428 (309.8)	5,320 (372.3)	6,212 (434.7)	7,104 (497.1)	7,996 (559.5)	
210 (48.2)		1,939 (135.7)	2,925 (204.7)	3,911 (273.7)	4,897 (342.7)	5,883 (411.6)	6,869 (480.6)	7,855 (549.6)	8,841 (618.6)	
230 (52.8)			3,207 (224.4)	4,287, (300.0)	5,367 (375.5)	6,447 (451.1)	7,526 (526.6)	8,606 (602.2)		
250 (57.4)			3,489 (244.1)	4,662 (326.2)	5,836 (408.4)	7,010 (490.5)	8,184 (572.7)	9,358 (654.8)		
270 (62.0)			3,770 (263.8)	5,038 (352.5)	6,306 (441.2)	7,573 (529.9)	8,841 (618.6)			
290 (66.6)			4,052 (283.5)	5,414 (378.8)	6,775 (474.1)					

[1/] Block indicates extent of basic data from 125 stands, ages 22 to 125 years.

[2/] Stand volume includes stem volume of all trees larger than 0.5 inch (1.27 cm) d.b.h

permanent sample plots in Montana and Idaho.[3] An example of the nature of this strong relationship is given in figure 1, for stand volumes in trees larger than 4.5 inches (11.4 cm) d.b.h. to a 4-inch (10.2-cm) top. All plottings for the various minimum diameters and top utilization combinations showed tight grouping of data points along the fitted lines as shown in figure 1; however, separate curves were obviously involved with each combination.

Table values of ratios were read from each curve for an appropriate set of mean stand diameters. They are presented as tables 2 through 7 for minimum merchantable diameters at breast height of 2.6, 4.6, and 6.6 inches (6.5, 11.7, and 16.8 cm) and top utilization limits of 1, 2, 3, 4, 5, and 6 inches (2.5, 5.1, 7.6, 10.2, 12.7, and 15.2 cm) diameter inside bark (d.i.b.).

[3]Details of methods used for equation development can be found in the previous publication (Cole 1971).

APPLICATION

Total gross cubic-foot volume per acre of a stand is estimated by either of two approaches: (1) by referring to table 1, the stand volume table, or (2) by obtaining stand basal area in square feet per acre, average height of dominant trees in feet, and substituting these values into the lodgepole pine stand volume equation (page 2). In the latter approach, volume in metric units can be obtained by multiplying the volume in cubic feet per acre by 0.0699726 to obtain cubic meters per hectare.

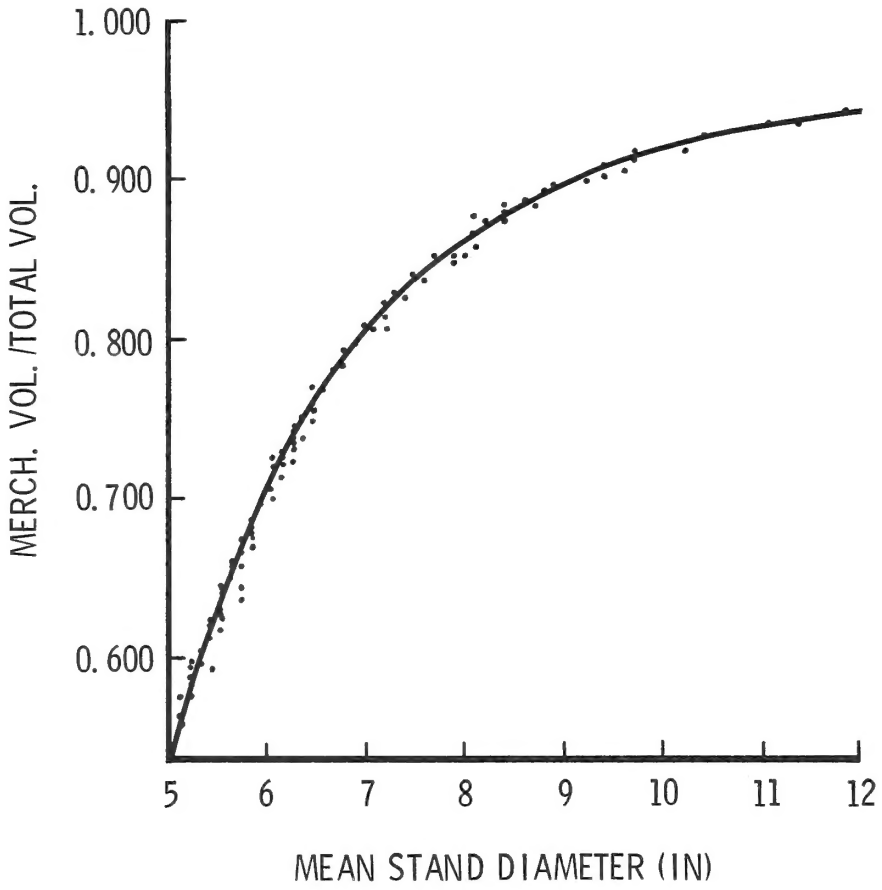

Figure 1.--Ratios of merchantable volume to total cubic volume over mean stand diameters for trees ≥ 4.6 inches (11.7 cm) d.b.h. (Merchantable volume was calculated for a stump height of 0.5 foot (0.15 m) and a minimum top diameter of 4 inches (19.2 cm), inside bark, using Honer's (1967) volume distribution function for lodgepole pines.)

Basal area per acre can be determined from a diameter tally of fixed-radius plots, or from variable-radius plots using an angle gage or wedge prism. The latter method is recommended for efficiency

For variable-plot cruising, an angle factor should be chosen to give about seven "count" trees per point. Generally, an angle factor of 10 will give satisfactory results. Only those trees with diameters larger than the minimum size of interest should be included in the point tally.

When merchantable cubic-foot volume is desired, it is also necessary to measure and record the d.b.h. of "count" trees of the sizes of interest at each sample point to obtain mean diameter for use with tables 2 through 7. Mean diameter ($\overline{D}$) for variable-radius plots is calculated with the formula (Stage 1962):

$$\overline{D} = \Sigma d_i^3 / \Sigma d_i^2$$

where d = d.b.h. of individual tree in the point sample,

i = 1 to n, and

n = the number of "count" trees in the point sample.

Tables 2 through 7 can also be used with fixed-plot data by calculating both basal area per acre and arithmetic mean d.b.h. from the fixed plot d.b.h. tally.

Height of average dominant trees should be measured to the nearest foot at each variable-plot sampling point. One or two height measurements per plot will furnish a representative height of dominant trees if the cruise is adequate for sampling basal area. To avoid overestimates of volume resulting from the tendency to measure outstandingly tall trees in the stand, one should scan surrounding trees and select one or two "average-appearing" dominants for height measurements. These heights will then be comparable to the "10-tree" average dominant heights used in the development of the stand volume equation.

Determination of sample size is a sampling problem dependent on the stand variability and degree of precision desired. Where experience in similar stands is lacking, a preliminary survey to estimate basal area variation is recommended; then a suitable sample size can be determined in the conventional manner.

To obtain merchantable gross cubic volume per unit area, for either the English or metric system, multiply the estimate of total cubic volume by the appropriate merchantable volume conversion factor (ratio). The conversion factor is found in the appropriate table for the minimum included d.b.h. (tables 2 through 7), by looking up the ratio for the mean diameter of the subject stand, under the appropriate column for top diameter inside bark. To illustrate, suppose a stand is found to have a mean diameter of 10.0 inches (25.4 cm) and a gross total volume of 6,490 ft^3/acre (454.1 m^3/ha). It is desired to find the gross merchantable cubic volume included in all trees 4.6 inches (11.7 cm) d.b.h. and larger when utilized to a 2-inch (5.1-cm) top diameter inside bark. Table 3 provides the conversion factors for these d.b.h. and top diameter limits. Examining it we find in the column for a 2-inch (5.1-cm) top, that the merchantable conversion factor for an average stand diameter of 10.0 inches (25.4 cm) is 0.958. Multiplying the gross total cubic stand volume estimate by this factor gives us the gross merchantable cubic volume per unit area of the stand:

$$6{,}490 \text{ ft}^3/\text{ac} \times 0.958 = 6{,}217 \text{ ft}^3/\text{acre}$$

or

$$454.1 \text{ m}^3/\text{ha} \times 0.958 = 435.0 \text{ m}^3/\text{hectare}.$$

Table 2.--*Factors for conversion of total cubic stand volume to merchantable cubic stand volume for all trees ≥ 2.6 inches (6.5 cm) d.b.h.; with top utilization limits of 1.0 inch (2.5 cm) and 2.0 inches (5.1 cm) d.i.b., and stump heights of 0.5 foot (0.15 m)*

Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume	
	1-inch top (2.5-cm)	2-inch top (5.1-cm)
3.0 (7.6)	0.941	0.739
3.1 (7.9)	.943	.760
3.2 (8.1)	.944	.777
3.3 (8.4)	.945	.791
3.4 (8.6)	.946	.803
3.5 (8.9)	.947	.815
3.6 (9.1)	.948	.823
3.7 (9.4)	.949	.830
3.8 (9.7)	.950	.837
3.9 (9.9)	.951	.844
4.0 (10.2)	.952	.850
4.1 (10.4)	--	.856
4.2 (10.7)	.954	.862
4.3 (10.9)	--	.868
4.4 (11.2)	.955	.874
4.5 (11.4)	--	.880
4.6 (11.7)	.956	.886
4.7 (11.9)	--	.892
4.8 (12.2)	.957	.897
4.9 (12.5)	--	.902
5.0 (12.7)	.958	.907
5.1 (13.0)	--	.911
5.2 (13.2)	--	.915
5.3 (13.5)	--	.918
5.4 (13.7)	--	.921
5.5 (14.0)	0.959	0.924
5.6 (14.2)	--	.926
5.7 (14.5)	--	.928
5.8 (14.7)	--	.930
5.9 (15.0)	--	.932
6.0 (15.2)	.960	.934
6.2 (15.8)	--	.936
6.4 (16.3)	--	.938
6.5 (16.5)	.961	--
6.6 (16.8)	--	.940
6.8 (17.3)	--	.942
7.0 (17.8)	.962	.944
7.2 (18.3)	--	.946
7.4 (18.8)	--	.947
7.6 (19.3)	--	.948
7.8 (19.8)	--	.949
8.0 (20.3)	.963	.950
8.5 (21.6)	--	.952
9.0 (22.9)	.964	.954
9.5 (24.1)	--	.955
10.0 (25.4)	.964	.956
10.5 (26.7)	--	.957
11.0 (27.9)	.965	.958
11.5 (29.2)	--	.959
12.0 (30.5)	.965	.960

Table 3.--*Factors for conversion of total cubic stand volume to merchantable cubic stand volume for all trees ≥ 4.6 inches (11.7 cm) d.b.h.; with top utilization limits of 1.0 inch (2.5 cm) and 2.0 inches (5.1 cm) d.i.b., and stump heights of 0.5 foot (0.15 m)*

Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume		Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume	
	1-inch top (2.5-cm)	2-inch top (5.1-cm)		1-inch top (2.5-cm)	2-inch top (5.1-cm)
5.0 (12.7)	0.959	0.923	6.8 (17.3)	--	0.946
5.1 (13.0)	--	.925	6.9 (17.5)	--	.946
5.2 (13.2)	--	.927	7.0 (17.8)	0.962	.947
5.3 (13.5)	--	.929	7.2 (18.3)	--	.948
5.4 (13.7)	--	.931	7.4 (18.8)	--	.949
5.5 (14.0)	.960	.933	7.6 (19.3)	--	.950
5.6 (14.2)	--	.934	7.8 (19.8)	--	.951
5.7 (14.5)	--	.935	8.0 (20.3)	.963	.952
5.8 (14.7)	--	.936	8.2 (20.8)	--	.953
5.9 (15.0)	--	.937	8.4 (21.3)	--	.953
6.0 (15.2)	.961	.938	8.6 (21.8)	--	.954
6.1 (15.5)	--	.939	8.8 (22.4)	--	.955
6.2 (15.8)	--	.940	9.0 (22.9)	.964	.955
6.3 (16.0)	--	.941	9.5 (24.1)	--	.957
6.4 (16.3)	--	.942	10.0 (25.4)	.964	.958
6.5 (16.5)	--	.943	10.5 (26.7)	--	.959
6.6 (16.8)	--	.944	11.0 (27.9)	.965	.960
6.7 (17.0)	--	.945	12.0 (30.5)	.965	.961

Table 4.--*Factors for conversion of total cubic stand volume to merchantable cubic stand volume for all trees ≥ 4.6 inches (11.7 cm) d.b.h.; with top utilization limits of 3.0 inches (7.6 cm) and 4.0 inches (10.2 cm) d.i.b., and stump heights of 0.5 foot (0.15 m)*

Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume	
	3-inch top (7.6-cm)	4-inch top (10.2-cm)
5.0 (12.7)	0.809	0.536
5.1 (13.0)	.818	.560
5.2 (13.2)	.826	.583
5.3 (13.5)	.834	.603
5.4 (13.7)	.841	.621
5.5 (14.0)	.846	.637
5.6 (14.2)	.851	.652
5.7 (14.5)	.856	.666
5.8 (14.7)	.861	.679
5.9 (15.0)	.866	.692
6.0 (15.2)	.870	.705
6.1 (15.5)	.874	.717
6.2 (15.8)	.878	.729
6.3 (16.0)	.882	.740
6.4 (16.3)	.886	.751
6.5 (16.5)	.890	.761
6.6 (16.8)	.893	.771
6.7 (17.0)	.896	.779
6.8 (17.3)	.899	.787
6.9 (17.5)	.902	.794
7.0 (17.8)	.904	.801
7.1 (18.0)	.906	.807
7.2 (18.3)	.908	.813
7.3 (18.5)	.910	.819
7.4 (18.8)	.912	.824
7.5 (19.0)	.914	.829
7.6 (19.3)	.916	.834
7.7 (19.6)	.918	.839
7.8 (19.8)	.920	.843
7.9 (20.1)	.922	.847
8.0 (20.3)	.923	.851
8.1 (20.6)	--	.855
8.2 (20.8)	.926	.859
8.3 (21.1)	--	.863
8.4 (21.3)	.928	.867
8.5 (21.6)	--	.871
8.6 (21.8)	0.930	0.875
8.7 (22.1)	--	.879
8.8 (22.4)	.932	.882
8.9 (22.6)	--	.885
9.0 (22.9)	.934	.888
9.1 (23.1)	--	.891
9.2 (23.4)	.936	.894
9.3 (23.6)	--	.897
9.4 (23.9)	.938	.900
9.5 (24.1)	--	.903
9.6 (24.4)	.940	.906
9.7 (24.6)	--	.909
9.8 (24.9)	.942	.911
9.9 (25.2)	--	.913
10.0 (25.4)	.944	.915
10.1 (25.7)	--	.917
10.2 (25.9)	--	.918
10.3 (26.2)	--	.919
10.4 (26.4)	--	.920
10.5 (26.7)	.947	.921
10.6 (26.9)	--	.922
10.7 (27.2)	--	.923
10.8 (27.4)	--	.924
10.9 (27.7)	--	.925
11.0 (27.9)	.950	.926
11.1 (28.2)	--	.927
11.2 (28.5)	--	.928
11.3 (28.7)	--	.929
11.4 (29.0)	--	.930
11.5 (29.2)	.951	.931
11.6 (29.5)	--	.932
11.7 (29.7)	--	.933
11.8 (30.0)	--	.934
11.9 (30.2)	--	.935
12.0 (30.5)	.952	.936

Table 5.--*Factors for conversion of total cubic stand volume to merchantable cubic stand volume for all trees ≥ 6.6 inches (16.8 cm) d.b.h.; with top utilization limits of 1.0 inch (2.5 cm) and 2.0 inches (5.1 cm) d.i.b., and stump heights of 0.5 foot (0.15 m)*

Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume	
	1-inch top (2.5-cm)	2-inch top (5.1-cm)
7.0 (17.8)	0.963	0.949
7.1 (18.0)	.963	.950
7.3 (18.5)	.963	.951
7.5 (19.0)	.963	.952
7.7 (19.6)	.963	.953
8.0 (20.3)	.964	.954
8.5 (21.6)	.964	.955
9.0 (22.9)	.964	.956
9.5 (24.1)	.964	.957
10.0 (25.4)	.964	.958
10.5 (26.7)	.964	.959
11.0 (27.9)	.965	.960
12.0 (30.5)	.965	.961

Table 6.--*Factors for conversion of total cubic stand volume to merchantable cubic stand volume for all trees ≥ 6.6 inches (16.8 cm) d.b.h.; with top utilization limits of 3.0 inches (7.6 cm) and 4.0 inches (10.2 cm) d.i.b., and stump heights of 0.5 foot (0.15 m)*

Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume		Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume	
	3-inch top (7.6-cm)	4-inch top (10.2-cm)		3-inch top (7.6-cm)	4-inch top (10.2-cm)
7.0 (17.8)	0.912	0.828	9.6 (24.4)	0.943	0.912
7.1 (18.0)	.914	.835	9.7 (24.6)	--	.914
7.2 (18.3)	.916	.842	9.8 (24.9)	.944	.915
7.3 (18.5)	.918	.848	9.9 (25.2)	--	.916
7.4 (18.8)	.920	.853	10.0 (25.4)	.945	.917
7.5 (19.0)	.922	.857	10.1 (25.7)	--	.918
7.6 (19.3)	.924	.861	10.2 (25.9)	.946	.919
7.7 (19.6)	.926	.865	10.3 (26.2)	--	.920
7.8 (19.8)	.927	.868	10.4 (26.4)	.947	.921
7.9 (20.1)	.928	.871	10.5 (26.7)	--	.922
8.0 (20.3)	.929	.874	10.6 (26.9)	.948	.923
8.1 (20.6)	.930	.877	10.7 (27.2)	--	.924
8.2 (20.8)	.931	.880	10.8 (27.4)	.949	.925
8.3 (21.1)	.932	.883	10.9 (27.7)	--	.926
8.4 (21.3)	.933	.886	11.0 (27.9)	.950	.927
8.5 (21.6)	.934	.889	11.1 (28.2)	--	.928
8.6 (21.8)	.935	.892	11.2 (28.5)	--	.929
8.7 (22.1)	.936	.894	11.3 (28.7)	--	.930
8.8 (22.4)	.937	.896	11.4 (29.0)	--	.931
8.9 (22.6)	.938	.898	11.5 (29.2)	.951	.932
9.0 (22.9)	.939	.900	11.6 (29.5)	--	.933
9.1 (23.1)	.940	.902	11.7 (29.7)	--	.934
9.2 (23.4)	.941	.904	11.8 (30.0)	--	.935
9.3 (23.6)	--	.906	11.9 (30.2)	--	.935
9.4 (23.9)	.942	.908	12.0 (30.5)	.952	.936
9.5 (24.1)	--	.910			

Table 7.--*Factors for conversion of total cubic stand volume to merchantable cubic stand volume for all trees ≥ 6.6 inches (16.8 cm) d.b.h.; with top utilization limits of 5.0 inches (12.7 cm) and 6.0 inches (15.2 cm) d.i.b., and stump heights of 0.5 foot (0.15 m)*

Mean stand diameter [inches (cm)]	Ratio of merchantable volume to total volume	
	5-inch top (12.7-cm)	6-inch top (15.2-cm)
7.0 (17.8)	0.668	0.391
7.1 (18.0)	.684	.427
7.2 (18.3)	.700	.463
7.3 (18.5)	.711	.484
7.4 (18.8)	.722	.505
7.5 (19.0)	.733	.521
7.6 (19.3)	.744	.537
7.7 (19.6)	.751	.552
7.8 (19.8)	.758	.566
7.9 (20.1)	.764	.580
8.0 (20.3)	.770	.593
8.1 (20.6)	.776	.606
8.2 (20.8)	.782	.618
8.3 (21.1)	.788	.630
8.4 (21.3)	.794	.642
8.5 (21.6)	.800	.653
8.6 (21.8)	.806	.664
8.7 (22.1)	.811	.675
8.8 (22.4)	.816	.686
8.9 (22.6)	.821	.697
9.0 (22.9)	.826	.706
9.1 (23.1)	.831	.714
9.2 (23.4)	.836	.722
9.3 (23.6)	.841	.730
9.4 (23.9)	.845	.738
9.5 (24.1)	.849	.746
9.6 (24.4)	0.853	0.754
9.7 (24.6)	.857	.762
9.8 (24.9)	.861	.770
9.9 (25.2)	.865	.778
10.0 (25.4)	.868	.785
10.1 (25.7)	.871	.791
10.2 (25.9)	.874	.796
10.3 (26.2)	.877	.801
10.4 (26.4)	.879	.806
10.5 (26.7)	.881	.811
10.6 (26.9)	.883	.816
10.7 (27.2)	.885	.821
10.8 (27.4)	.887	.826
10.9 (27.7)	.889	.830
11.0 (27.9)	.891	.834
11.1 (28.2)	.893	.837
11.2 (28.5)	.895	.840
11.3 (28.7)	.897	.843
11.4 (29.0)	.899	.846
11.5 (29.2)	.901	.849
11.6 (29.5)	.902	.852
11.7 (29.7)	.903	.854
11.8 (30.0)	.904	.856
11.9 (30.2)	.905	.858
12.0 (30.5)	.906	.860

Notice that the equations and tables presented here are in units of *gross* volume per unit area. No cull or defect allowances were involved in their development. To obtain realistic *net* volume estimates, users should make appropriate volume deductions for cull and defect on the basis of data and experience from stand surveys, scaling, and mill-defect studies.

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